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Storage Products Division
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Deploying ProLiant DL320 and DL360 Servers into Telecommunication (Telco) Racks

Abstract: Compaq ProLiant DL320 and ProLiant DL360 servers were developed with high volume deployment in mind. As a result, Compaq addresses environmental, thermal, mechanical, power, installation and service considerations for the server and rack specific options.

While Compaq 9000 and 7000 series racks are ideal for this ultra-dense server, Compaq recognizes that customers may want to plan and implement deployments using telecommunications (telco) racks. This document describes deployments involving the Compaq ProLiant DL360 server and the Compaq Telco Rack Option Kit.

Compaq provides hardware, specifications, and guidelines for ultra-dense deployment schemes using telco racks as a service to its customers.

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Introduction

Compaq designed the *ProLiant*™ DL320 and ProLiant DL360 ultra-dense servers with maximally configured deployments in mind. The Compaq ProLiant DL320 and ProLiant DL360 servers require only 1U (1.75 inches) of rack height.

This document discusses installation and service issues that arise when working with ultra-dense server deployment, including:

- Mounting options for varying rack environments
- Weight
- Power distribution
- Thermal and environmental considerations
- Console management choices
- Cable management
- Unit identification

This paper provides guidelines for deploying multiple Compaq ProLiant DL360 servers in a telco rack environment using the Compaq Telco Rack Option Kit (P/N: 174576-B21), and provides information on Compaq rack products and related options. For information regarding third-party racks, see the white paper, "Compaq Ultra-Dense Server Deployment in Third-Party Racks," Compaq Document Number 13NT-1000A-WWEN available at www.compaq.com

Figure 1: Compaq ProLiant DL320 ultra-dense server

Figure 2: Compaq ProLiant DL360 ultra-dense server

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Following the guidelines in this document will minimize planning and installation time; however, do not use this document as your sole source of information for the rack installation. Other rack installation references include:

- Compaq Third-Party Rack Option Kit installation guide (poster included with eacb kit).
- "Compaq Ultra-Dense Server Deployment Solutions Overview," white paper available at www.compaq.com
- Compaq Rack Builder Pro design and planning software utility, available for download from the Compaq website at www.compaq.com/racks
- Product-specific user guides and manuals

Rack Warnings

This document should be used only as an information source for planning your deployment. Avoid personal injury and equipment damage by following accepted safety practices.

WARNING: Ensure proper floor support. Deployment of ultra-dense servers, related equipment, and cables exceeds 1,800 pounds for a Compaq ProLiant DL360 single 42U rack and 1,700 pounds for a ProLiant DL320 single 42U rack.

WARNING: Be aware of the center of gravity and tip hazard. Compaq recommends that the rack footings extend 10 inches from the front and back of any Compaq rack 22U or higher. Adequate stabilization measures are required. Ensure that the entire rack assembly is properly secured and that all personnel are trained in proper maintenance and operation procedures. Tip bazards include personal injury and death.

CAUTION: Ensure your installation has adequate power supply and branch circuit protection.

CAUTION: Thermal dissipation requirements of an ultra-dense server deployment mandate minimum unrestricted airspace of 3 inches in both the front and the rear of each Compaq ProLiant DL320 and ProLiant DL360 server.

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Telco Rack Option Kit

Compaq ProLiant DL320

The Compaq Telco Rack Option Kit for Compaq ProLiant DL320 servers provides a complete mounting solution that adapts to a variety of telco racks. The telco rack rails adjust to accommodate telco rack frame thickness from 3 to 5 inches (7.62 to 12.7 cm).

Compaq ProLiant DL360

The Compaq Telco Rack Option Kit for Compaq ProLiant DL360 servers provides a complete mounting solution that adapts to a variety of telco racks. The telco rack rails adjust to accommodate telco rack frame thickness from 3 to 5 inches (7.62 to 12.7 cm).

Kit Contents

The installation kit includes a set of adjustable rack rails that attach to telco racks using fasteners included in the kit. The rack rails mate to optional server rails that replace the standard rails preinstalled on the Compaq ProLiant DL320 and ProLiant DL360 server.

The Compaq Telco Rack Option Kit comes with a detailed installation guide. Consult the installation guide for details on adapting the option kit to your telco rack.

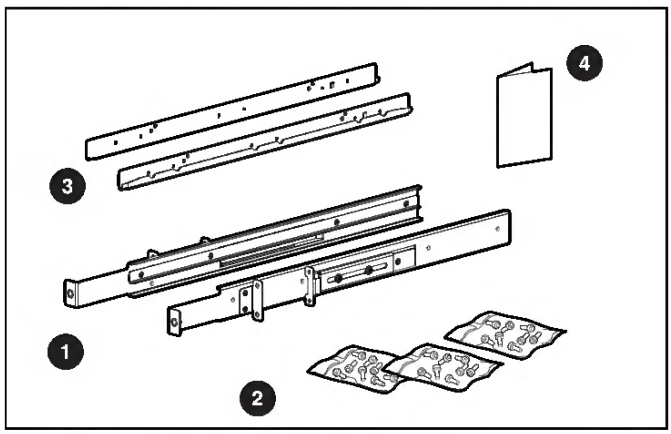

Figure 3: The Telco Rack Option Kit

Table 1. Telco Rack Option Kit

Item	Description
❶	Rack Rails
❷	Fasteners
❸	Optional Server Rails
❹	Installation Guide

Note: The Compaq Telco Rack Option Kit is for fixed rail installation. Although the Compaq ProLiant DL320 and ProLiant DL360 servers slide in for installation, remove the servers from the rack for service.

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Cantilever Design

The Compaq Telco Rack Option Kit rack rails support the server, distributing the load in the front ❶ and to the rear ❷. This balanced cantilever design balances the installation much better than a full cantilever design. The balanced cantilever installation is robust, without blocking access to other front panel mount equipment in the rack.

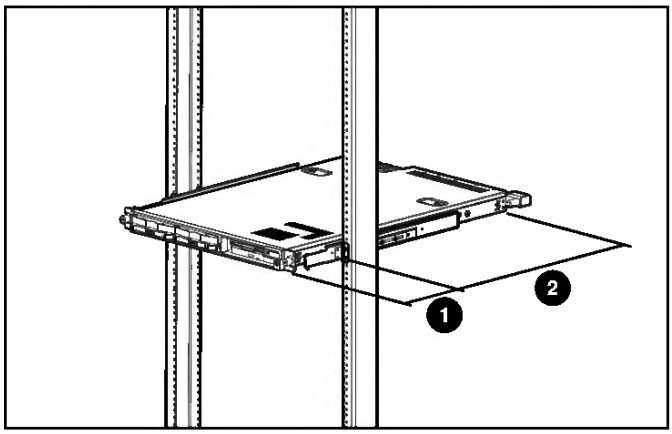

Figure 4: Cantilever specifications for Telco Rack Option Kit (Compaq ProLiant DL360 shown)

WARNING: The center of gravity of fully configured Compaq ProLiant DL320 and ProLiant DL360 servers installed using the Compaq Telco Rack Option Kit is slightly behind the telco rails. The telco rack must be fully secured to adequate support structures for deployments of ultra-dense 1U Compaq ProLiant DL360 servers.

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Server Specifications for Deployment

Compaq ProLiant DL320 and ProLiant DL360 server specifications include:

- Weight
- Minimum and maximum dimensions for kit installation
- Power consumption
- Thermal dissipation

Weight

A fully configured Compaq ProLiant DL320 server weighs 25 pounds. The ProLiant DL320 Server includes:

- Two Wide Ultra3 hard disk drives.
- A Remote Insight Lights-Out Edition option.
- Standard server rails attached to the server chassis.

A fully configured Compaq ProLiant DL360 server weighs 29 pounds. The ProLiant DL360 Server includes:

- Two Wide Ultra3 hard disk drives.
- A Remote Insight Lights-Out Edition option.
- Standard server rails attached to the server chassis.

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Table 2 lists the weights of individual components used in deployments of Compaq ProLiant DL320 and ProLiant DL360 servers in telco racks.

Table 2. Component Weights for Calculation

Item	Weight (ProLiant DL320)	Weight (ProLiant DL360)
Configured (1 server)	25.00 lb	29.00 lb
Fully configured (42 servers)	1,030 lb (approx)	1,200 lb (approx)
Wide Ultra3 hard disk drive	1.90 lb	1.90 lb
Remote Insight Lights-Out Edition option	0.50 lb	0.50 lb
Telco Rack Option Kit rack rails (set)	2.50 lb	2.50 lb
KVM cable bundle	1.42 lb	1.42 lb
High voltage Y power cable	1.00 lb	1.00 lb
Server console switch	5.25 lb	5.25 lb

WARNING: External cable weight contributes to the overall weight of the rack installation. Because cable installation and load-bearing designs vary greatly, carefully consider cable weight in all designs.

WARNING: Do not exceed the specified weight limit for the telco rack or the floor. When creating deployments of Compaq ProLiant DL320 or ProLiant DL360 ultra-dense servers in a telco rack, include in the weight calculations the weight of the rack rails, cable management trays, and cables whose load is bearing on the rack.

CAUTION: Ensure that the cabling design provides both adequate airspace for thermal dissipation and strain relief for the cable connections on the Compaq ProLiant DL360 or ProLiant DL320 server if the cable management tray is not used. The cable management tray design reduces cable congestion and relieves strain on connectors.

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If the Compaq ProLiant DL360 and ProLiant DL360 servers do not include Wide Ultra3 hard disk drives ❶, or a Remote Insight Lights-Out Edition option ❷, subtract those component weights from the weight total.

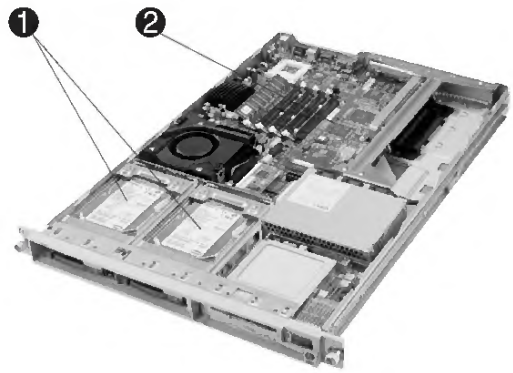

Figure 5: Hard drive and Remote Insight locations (DL360 shown)

Floor Loading

All buildings and raised computer room floors are engineered to provide a specific floor loading. The floor area beneath the rack must be designed to provide proper support for a fully populated rack. When configuring a system, ensure that the floor loading specifications are adhered to. Failure to do so may result in physical injury or damage to the equipment and the facility.

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Dimensions

Compaq designed the Compaq Telco Rack Option Kit to comply with EIA 310-D specifications for rack width.

Table 3 lists the minimum dimensions for installing Compaq ProLiant DL320 and ProLiant DL360 servers using the Compaq Telco Rack Option Kit. When designing deployments of ultra-dense servers in telco racks, include the minimum airspace requirements for the server.

IMPORTANT: Any installation of Compaq ProLiant DL360 servers will require 3 inches airspace front and back.

Table 3. Minimum space requirements for ProLiant DL320 and ProLiant DL360 servers installed using Compaq Telco Rack Option Kit

		ProLiant DL320	ProLiant DL360
❶	Height	1.75 in (1U)	1.75 in (1U)
❷	Width	17.72 in	17.72 in
❸	Unrestricted airspace measured forward from front of telco rack[1]	8.65 in (5.65 in cantilever space, plus 3 in of airspace for thermal dissipation)	
❹	Unrestricted airspace measured rearward from front of telco rack[2]	22 in (19 in cantilever space, plus 3 in of airspace for thermal dissipation)	

Note 1: The minimum space requirements above do not include the spatial requirements for sliding the ProLiant DL360 server onto the rack rails. This installation procedure requires at least 27 inches, measured forward from the front of the telco rack.

Note 2: The minimum space requirements above do not include the recommended spatial requirements for cable installation and service procedures. Compaq recommends at least 8 inches for cable attachment and service procedures, measured from the back of the installed server.

IMPORTANT: Compaq products are designed to provide airflow from the front of the rack to the rear. It is recommended that rack components only be installed on the front rails for many reasons, including proper airflow.

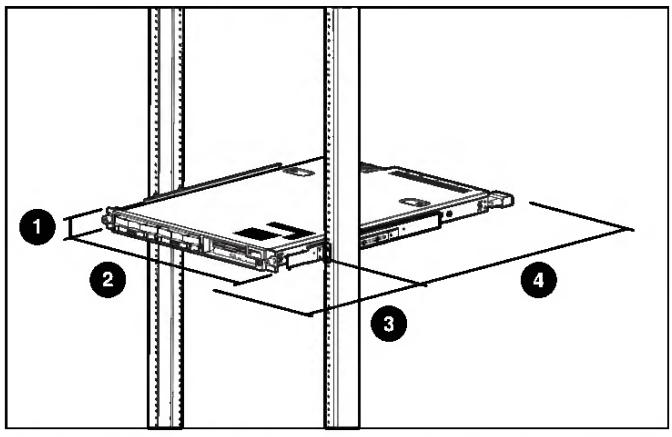

Figure 6: ProLiant server minimum space requirements (DL360 shown)

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Power Consumption

Power consumption requirements for Compaq ProLiant DL320 and ProLiant DL360 servers are listed in Table 4.

Table 4. Power Consumption

	ProLiant DL320	ProLiant DL360
Maximum DC output	180W	190W
Maximum AC input	200W	292W
Consumption using 110V AC, fully loaded	2.00A	2.66A
Consumption using 208V AC, fully loaded	1.00A	1.41A

Note. A simple formula to calculate server power requirements for installation is:
(number of ProLiant servers) * (Maximum AC input) = Maximum power requirements for servers
Example with 42 ProLiant DL320s. 42 * 200W = 8,400W

WARNING: To reduce the risk of personal injury, fire, or damage to the equipment, do not overload the AC supply branch circuit that provides power to the rack. Consult the electrical authority having jurisdiction over the facility wiring and installation requirements.

CAUTION: If the rack is equipped with an integrated power distribution scheme, make sure that the power distribution circuits are not overloaded.

Thermal Dissipation

The Compaq ProLiant DL320 and ProLiant DL360 servers' internal design achieves efficient cooling through unrestricted airflow. A large cooling fan and three smaller power supply fans move cool air from the front of the unit, over the heated components, and out the chassis through large, specially angled air vents at the rear of the unit.

Slots and openings in the product (see Figure 7 and Figure 8) are provided for ventilation and should never be blocked or covered, since these ensure reliable operation of the product and protect it from overheating. The product should not be placed in a built-up enclosure unless the enclosure has been specifically designed to accommodate the product, proper ventilation is provided for the product, and the manufacturer instructions have been followed.

The open "U" spaces in the front of a rack should have blanking panels installed to support the front-to-back air flow design needs. As a good practice, 24 inches (61 cm) of space should be allowed between the rack and other fixtures to ensure correct front-to-back airflow and allow service access.

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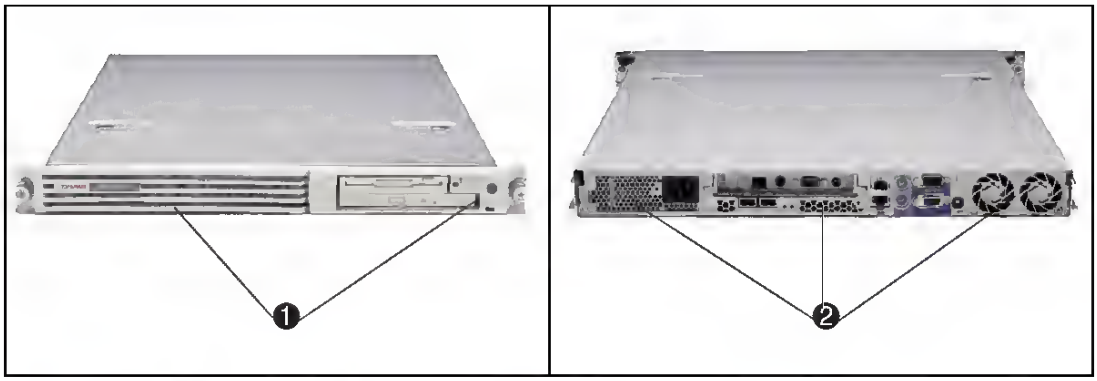

Figure 7: Intake ❶ and exhaust ❷ vents for the Compaq ProLiant DL320 server

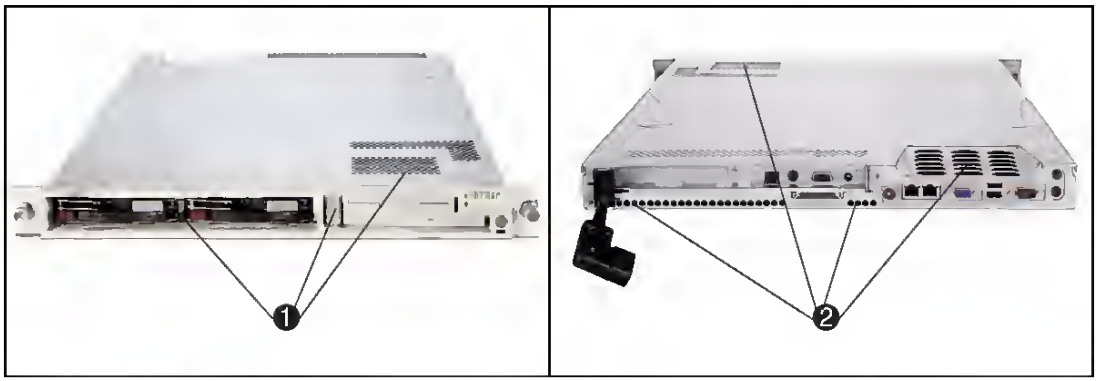

Figure 8: Intake ❶ and exhaust ❷ vents for the Compaq ProLiant DL360 server

When installed in a 1U ultra-dense server deployment, air flow is sufficient to cool Compaq ProLiant DL320 and ProLiant DL360 servers if the following criteria are met:

- Ambient air temperature at the front of the unit does not exceed 95°F (35°C).
- Relative humidity does not exceed 90 percent while operating.
- Unrestricted airspace of at least 3 inches is provided in front of the server.
- Unrestricted airspace of at least 3 inches is provided at the rear of the server.

Note: Cabling must not restrict airflow. The Compaq Telco Rack Option Kit includes a cable management tray to provide appropriate clearance for airflow. Ensure airflow exiting the server's exhaust vents is unrestricted if not using the cable management tray.

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Installation Procedures for Telco Racks

Adapt the following procedures to create deployments of ultra-dense Compaq ProLiant DL320 and ProLiant DL360 servers in a telco rack.

Installing the Compaq Telco Rack Option Kit Rack Rails

Install all rack rails to the telco frame before installing any servers. The rack rail mounting bracket opening adjusts from 3 to 5 inches (7.62 to 12.7 cm) to accommodate varying telco frame thickness. The adjustment screws require a #15 Torx driver or slothead screwdriver.

Refer to the *Compaq Telco Rack Option Kit Installation Guide* for complete instructions.

Compaq ProLiant DL320 and ProLiant DL360 servers ship with standard server rails attached. These rails must be removed and replaced with the optional server rails included in the Telco Rack Option Kit.

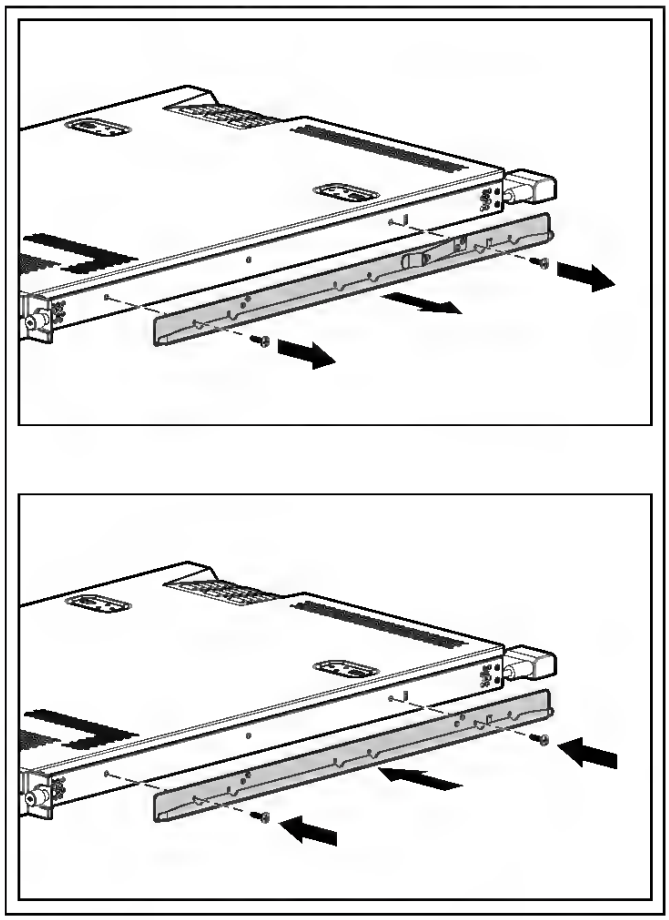

Figure 9: Replacing server rails with Telco Rack Option Kit server rails (DL360 shown)

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Installing Compaq ProLiant Servers in the Rack

After installing all the rack rails, start installing servers at the bottom of the rack and work upward. Slide the first server into the bottom set of rack rails. Secure the server to the rack rail nut using the thumbscrews attached to the server faceplate.

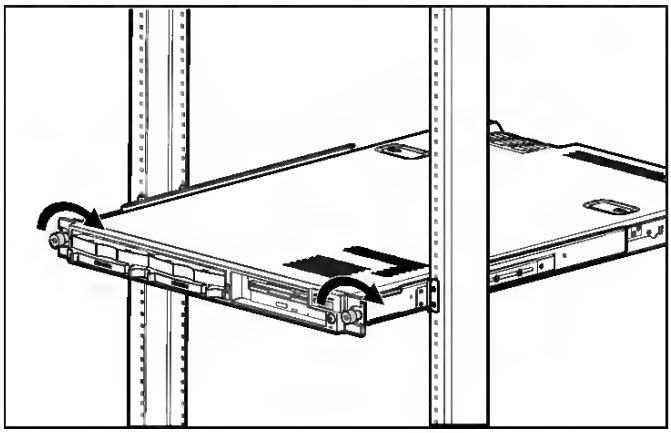

Figure 10: Using the thumbscrews to secure the server to the telco rack rail (ProLiant DL360 shown)

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Console Management for Ultra-Dense 1U Servers

The console management scheme determines cabling design and management.

Two ways to design a full rack deployment of ultra-dense 1U Compaq ProLiant DL320 or ProLiant DL360 servers include:

- Use of remote management option boards, such as the Remote Insight Lights-Out Edition board, in each server.
- Use of adjacent rack space to house remote console switches, monitors, and keyboards.

Remote Insight Lights-Out Edition

Remote management boards simplify server monitoring, control, and wiring. Typical wiring for a Compaq ProLiant DL320 or ProLiant DL360 server with a Remote Insight Lights-Out Edition installed is reduced to the server power cord, the Remote Insight Lights-Out Edition CAT5 network connection, and the two CAT5 cables to the redundant server NICs. The Compaq ProLiant DL320 and ProLiant DL360 servers use an internal cable to supply power to the Remote Insight Lights-Out Edition board and eliminate loop-back cabling for the keyboard, mouse, and video.

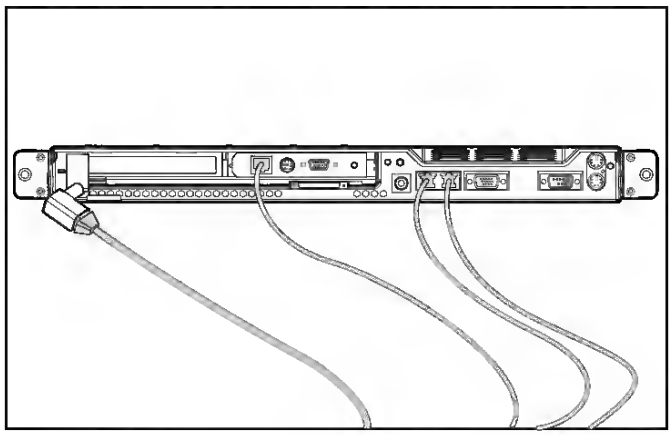

Figure 11: Typical cabling using the Remote Insight Lights-Out Edition (DL360 shown)

The Remote Insight Lights-Out Edition allows full graphical control of the server, even when the server operating system is down or the server is powered off. The Remote Insight Lights-Out Edition can cycle the power on the server, and allow a reboot from a "virtual floppy" imaged anywhere on the network. The Remote Insight Lights-Out Edition is accessed through a Web browser, and no additional software is required on the server or the system providing access.

For additional information on remote management options, consult the Compaq website at http://www.compaq.com/manage/

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Console Switches, Monitors, and Keyboards

The Compaq ProLiant DL320 and ProLiant DL360 servers can be cabled to a Compaq 1U console switch. Each of these low-profile console switches provides connectivity for up to eight servers. The console switches can be cascaded one level to provide connectivity for up to 64 servers. Using a 2U Compaq TFT display and Compaq keyboard options, customers can deploy Compaq ProLiant DL320 and ProLiant DL360 ultra-dense servers in minimal rack space configurations.

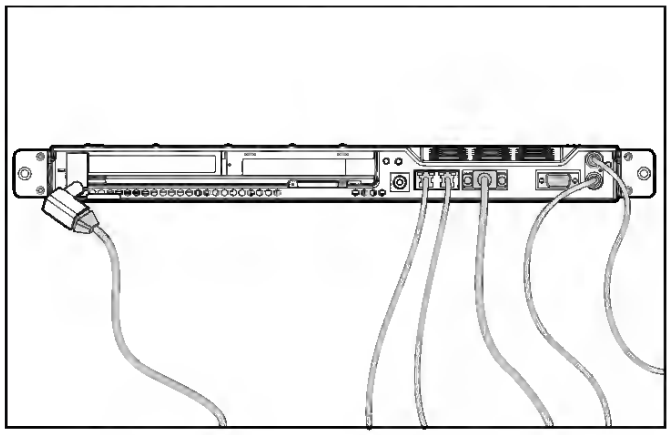

Figure 12: Typical cabling using server console switches (DL360 shown)

Cabling

Cabling will vary based on the I/O options. The Compaq ProLiant DL320 ships with a standard 10-foot IEC-IEC power cable for rack mount deployment using either a Power Distribution Unit (PDU) or Uninterruptible Power Supply (UPS). The ProLiant DL360 server ships with a standard 12-foot country specific power cable. For specific cabling solutions developed by Compaq, refer to the white papers, "Compaq ProLiant DL320 Ultra-Dense Server Deployment in Compaq Racks" and "Compaq ProLiant DL360 Ultra-Dense Server Deployment in Compaq Racks" available on the Compaq website:
www.compaq.com

CAUTION: Any cabling solution must ensure sufficient airspace for thermal dissipation and provide strain relief for cable connectors.

Note: For high-voltage installations, Compaq offers a High Volume Deployment Option Kit containing 11 Y-shaped high voltage power cables for powering two servers with one wire. This design provides clean power cable management.

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Figure 13 shows a typical in-rack local-console rack configuration for a 42U rack. A single 1U Internal Keyboard with Trackball and one 2U TFT5000R 15-inch Flat Panel Monitor support 35 ProLiant DL360 servers through five cascaded Server Console (KVM) switches.

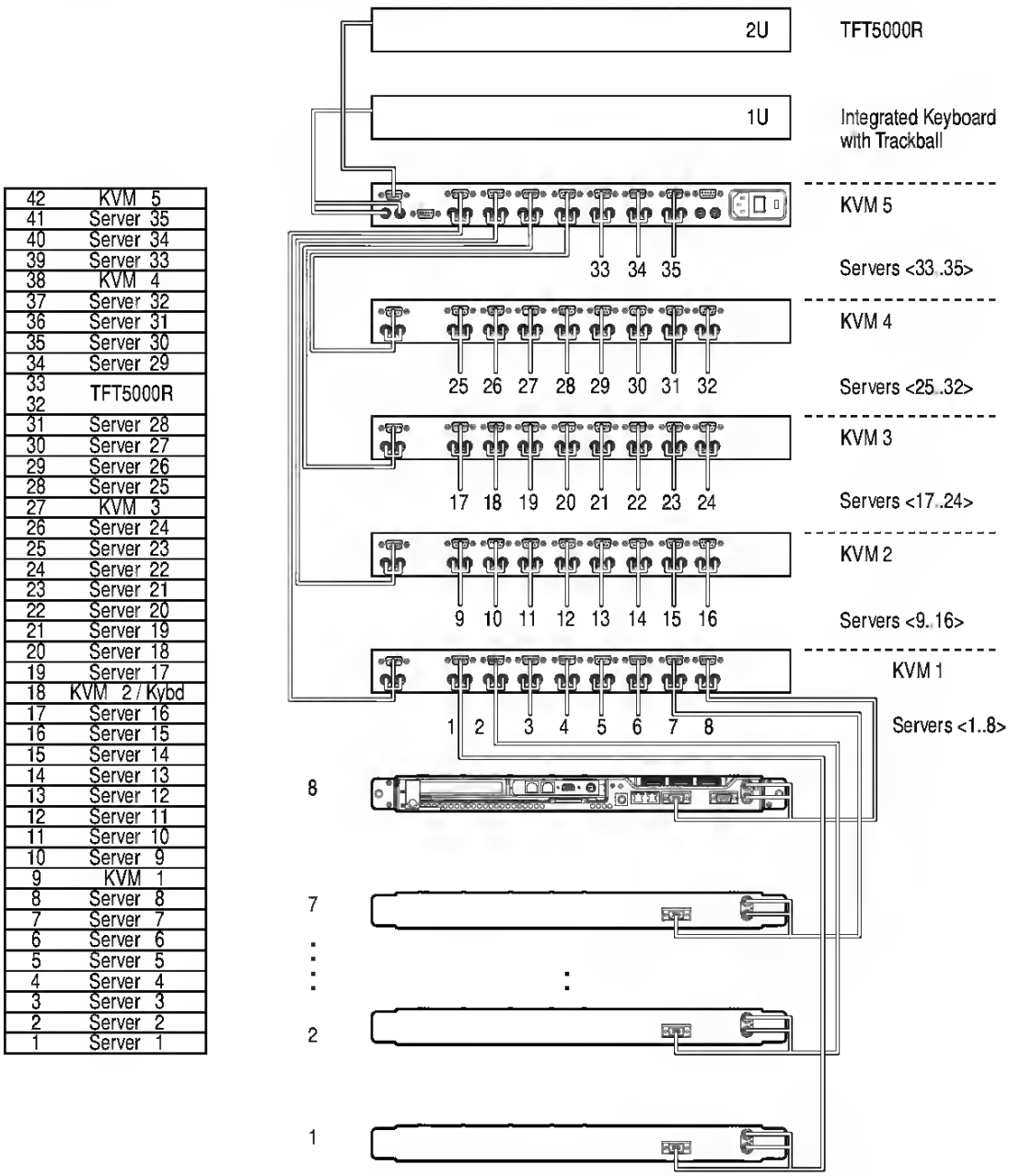

Figure 13: Typical KVM and cascading console switch solution for 35 Compaq ProLiant servers

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Appendix A

Unit Identification

In an ultra-dense server deployment, properly identifying a server requiring service can be difficult. The Compaq ProLiant DL320 and ProLiant DL360 servers include special LEDs that identify servers requiring service.

The Compaq ProLiant DL320 and ProLiant DL360 server Unit Identification (UID) features on the front and rear of the server simplify server identification in deployments of ultra-dense servers. The faceplate LED and switch are located on the right of the drives. The rear UID is an integrated LED and switch.

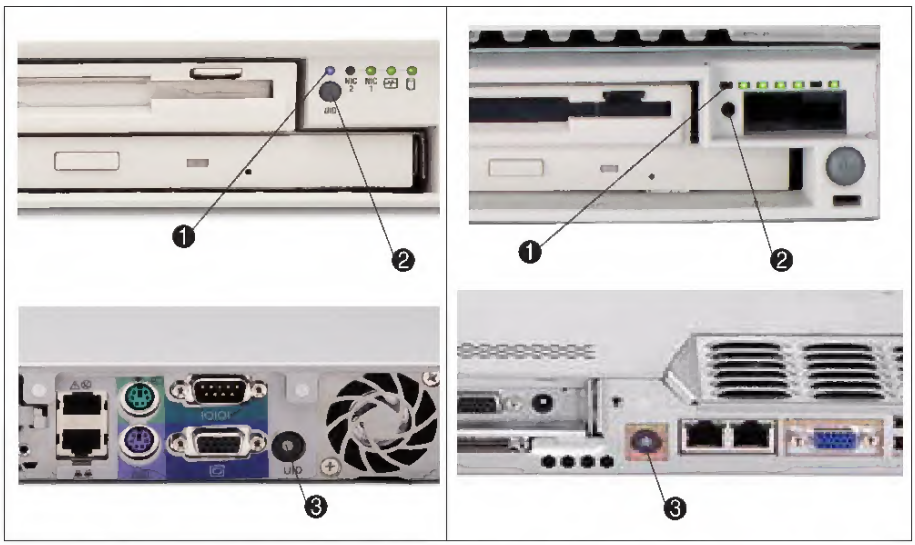

Figure 14: Unit Identification (UID) LEDs and switches (DL320 and DL360)

When the UID switch ❷ is on, the blue LEDs illuminate on the front ❶ and back ❸ of the server, marking it as targeted for service. This front-and-rear feature reduces the risk of disconnecting cables from the wrong server. Front and rear NIC link and NIC activity LEDs also help to identify servers requiring service.

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Appendix B

Compaq Rack Builder Pro

Compaq Rack Builder Pro is a Windows-based installation and configuration tool that simplifies the process of generating and maintaining rack environments by helping customers plan and configure Compaq racks with rack-mountable products.

Rack Builder Pro bas two modes of operation:

- Assisted Mode is for first time users or users who would like help in properly sizing their rack-mount components. Assisted Mode includes a simple interview session to help select the appropriate racks and rack-mount components. Functional and regulatory requirements are applied to automatically perform the calculations necessary to properly size power management products.
- Builder Mode is for more experienced users who are familiar with the Compaq product line. Builder Mode does not perform any of the calculations necessary for selecting and or sizing rack-mount components.

Configuration rules are sometimes used to help identify problematic configurations. They communicate good engineering practices and identify problems and limitations found during product qualification testing. These rules do not guarantee that the final system configuration will be safe and compliant, and do not absolve the final system integrator from responsibility for shipping safe and compliant products.

Key Features

Compaq Rack Builder Pro includes:

- Support for Compaq 9000, 7000, and 4000 Series racks and accessories
- Support for 2-5-2 and 6-3 part numbers
- Packet upgrades download updates, not the entire application
- Discontinued products that are listed as EOL (End of Life)
- Input power requirements and Earth Leakage Current computations
- Generation of reports

New features specific to the Assisted Mode include:

- Ability to select the number of power supplies for each component
- Ability to apply Earth Leakage Current, as well as functional and regulatory requirements, to configure Power Management Products (UPS and PDU)
- Ability to configure Server Console Switches and cables
- Ability to configure rack options and accessories, including stabilizing feet, baying/coupling kits, keyboards, tower to rack conversion kits, and so on

Rack Builder Pro can be reached through the main rack product website at http://www.compaq.com/racks

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Appendix C

Monitors, Keyboards, and Console Switches

Additional information about Compaq Storage Division products is available on the Compaq website at
http://www.compaq.com/racks

15-inch Flat Panel Monitor (TFT5000R)

The Compaq TFT5000R (15-inch) Flat Panel Monitor provides powerful performance in a space saving 2U-form factor for rack cabinet. This rack allows the monitor to be neatly tucked away when not in use.

1U Drawer and Internal Keyboard with Trackball

The Compaq 1U Keyboard Drawer and Internal Keyboard with Trackball provides convenience, reliable performance, and improved manageability in space-constrained rack-mount environments.

The 1U Keyboard Drawer requires half the depth of other keyboard drawers and provides mounting options for Compaq server console switches.

Console Switches

The family of Compaq Server Console Switches allows multiple servers in a rack to be accessed and managed by one keyboard, mouse, and monitor. The Compaq Server Console Switch family consists of one 2-Port, one 4-Port, and three 8-Port models. The three 8-Port models allowing system control by more then one user.

Part Numbers

Table 5 lists the part numbers for local console components.

Table 5. Local Console Components

Description	P/N	Notes
Server Console Switch 1x8-port (100-230VAC)	400337-B21	
	400337-291	Japan
	400337-B31	International
TFT5000R Flat Panel Monitor	120207-001	
	120207-291	Japan
	120207-B31	International
Rack Internal Trackball Keyboard - Opal	185152-186	
	185152-406	
Keyboard Tray	338-056-B21	
CPU-to-Switchbox Cable	110936-B24	3 ft cables
	110936-B25	6 ft cables

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Appendix D

Contact Us

For comprehensive online support, refer to:

http://www.compaq.com/

For international information, refer to:

http://www.compaq.com/corporate/overview/world_offices.html

For a list of Compaq products, refer to:

http://www.compaq.com/showroom/

For a list of Compaq rack options and accessories, refer to:

http://www.compaq.com/products/storageworks/rack_accessories/rack-accessories.html

For Compaq CustomSystems & Solutions, refer to:

http://www.compaq.com/solutions/customsystems/

Table 6. Departments and Telephone Numbers for the United States and Canada

Department	Telephone Numbers
Consumer Direct	1-800-888-0220
Compaq DirectPlus	1-800-888-5858 (U.S.)
Compaq Partner Direct	1-800-888-5874
Compaq Reseller Locator	1-800-345-1518 (Option 3)
Compaq Canada Reseller Locator and Product Literature	1-800-567-1616
Diskette Fulfillment (backup diskettes for preinstalled software)	1-800-952-7689 (U.S.) 1-800-349-8498 (Canada)
Compaq Product Information	1-800-345-1518 (U.S.) 1-800-567-1616 (Canada)
Compaq Technical Support	1-800-OK-COMPAQ (U.S. and Canada) 1-800-652-6672

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